BACKGROUND AND AFFECTED ENVIRONMENT

INTRODUCTION

The Northern Highland-American Legion State Forest (NH-AL) is located in central northern Wisconsin in Vilas, Oneida, and Iron Counties. This area epitomizes the state's "northwoods" with its vast forests, lakes, wetlands, streams, and diverse recreational opportunities. Almost half of the land within the region is publicly owned in national, state, and county forests.

The region's bountiful natural resources drive its economy, primarily through the forest products and tourism industries. Second-growth northern hardwood and aspen forests dominate most of the forests, while wetlands, streams, and lakes provide habitat for many species, including rare plants and animals.

The NH-AL, Wisconsin's largest state forest, has more than 226,000 acres of state-owned land. More than two million visitors come each year to enjoy the area's natural beauty. The forest's world-class lakes and easily accessible location near the Minocqua-Woodruff tourist center set the stage for the NH-AL to play a major role in the region's outdoor recreation.

EARLY HISTORY

The greatest event to shape the Northern Highland-American Legion State Forest landscape occurred some 10,000 years ago when the last glacier retreated. The Ontonogan Ice Lobe transported huge deposits of boulders, rocks, gravel and sand, or "outwash" as the foundation layers of sand and gravel are termed. Frequently, ice blocks broke off the retreating glacier, and became mired in the layers of outwash. As the ice blocks melted, they left deep depressions or "pits" that filled with water to become lakes. In fact, the glacier left one of the largest concentrations of these "kettle lakes" in the world. Over 900 lakes and hundreds of miles of streams and rivers lie within the state forest's boundaries. Vast wetlands formed where shallower ice blocks left low depressions.

The resulting pitted outwash helps define the ecological profile of the NH-AL State Forest. Most of the upland soils that developed in the centuries following the glacier are dry, sandy, and low in nutrients. Before European settlers came to the region, the sandy pitted outwash forests gave rise to one of the upper Midwest's extensive red and white pine-dominated forests with a mixture of white birch, aspen, and jack pine. Sandy soils, periodic fires, and other natural disturbances such as windstorms, insects or disease contributed to the formation of forests composed of white pine, red pine, aspen, red oak, and white birch.

The Menominee, Sioux, Ojibwe people occupied the NH-AL area from time immemorial to Euro-American settlement leaving a legacy not only of forest settlements and burial grounds, but also of ecological stewardship derived from an intimate and interdependent relationship with the natural world. Through the 1825 Prairie du Chien Treaty, these tribal nations resolved their own respective territorial claims and recognized the NH-AL area as within Ojibwe territory. While their respective histories are complicated and intertwined, a common thread running through their culture and lifestyles remains a profound connection to the natural world.

For the Ojibwe, this connection manifests itself today through the continuing exercise of their reserved rights to hunt, fish, and gather in the NH-AL as guaranteed in the 1837 and 1842 land cession treaties with the United States. Although disputed through a number of lawsuits during the 1970s and 1980s, these rights – including the rights to regulate these activities in cooperation with the state to ensure that they do not adversely impact species' long-term conserva-

tion needs – was affirmed in federal court in 1983 in what is known as the "Voight decision."

Throughout the 1800s, the young nation's expanding Euro-American population inexorably pushed further and further into the western Great Lakes. For Wisconsin's native peoples, in influx of settles accelerated the changes already underway. The new settlers were focused on staking a claim to property they could call their own. By 1860, through a series of sales, treaties, and armed conflicts, most tribal lands in Wisconsin had passed into the hands of non-Native Americans.

Gradually, pioneers, loggers and tourists came to the NH-AL region. Logging began in the 1890s and continued to boom in the early 1900s as the railroad system reached northward. Years of logging dramatically changed the forest's beauty, leaving behind stumps and slash, which in turn provide fuel for the forest fires that followed.

The barren and burned land lay unproductive, causing lumber companies to sell. The State Legislature saw value in this land, and beginning in 1907, provided the financial means to acquire large land holdings. By late 1908, the state had purchased a total of 33,884 acres in parts of Vilas, Oneida, and Iron counties. This land was designated as the Northern Wisconsin State Park.

The State Legislature established the Northern Highland State Forest in 1925 and the American Legion State Forest in 1929 from forest reserves set aside earlier in Iron, Oneida and Vilas counties. The two forests were managed separately until 1968, when they were combined into one administrative unit. Today, the NH-AL State Forest is Wisconsin's largest state-owned property.

PAST STATE FOREST MANAGEMENT AND USE

The Northern Wisconsin State Park, as the 1908 acreage was originally called, took on a pioneering role in initiating many programs that are important in forestry today. Wildfires were controlled, and an aggressive reforestation program began with the first state-owned tree nursery established at the Trout Lake Headquarters in 1911. Tree seedling production increased to 11 million trees per year during the era of the Civilian Conservation Corps (CCC), between 1933 and 1942.

The reforestation program on the Northern Highland State Forest began in 1911 with the planting of 154 acres. With the exception of two years, 1915 and 1943, the reforestation program has been in operation each year since 1911.

The program reached its peak in 1934 with the planting of 4,276 acres. From 1911 until 1949, the total acreage planted (original plus replanting) was 27,027 acres. The reforestation program on the American Legion State Forest began in 1931 and continued up to 1946, with the exception of 1935 and 1942. During that time, 3,722 total acres were planted (original plus replanted) (WCD 1950).

Early timber management included prescriptions for recreational and scenic considerations by designating river, lake, and roadside timber preserve strips. It also classed all state-owned islands as timber preserve areas, and established the Dunn Lake Natural Area, Escanaba Lake Natural Area, Star Lake Natural Area and Trout Lake timber preserve area. Land not reserved for aesthetic purposes was managed to produce the maximum volume of forest products.

Much of the area was reforested with pine or developed a second-growth forest dominated by early successional trees, such as aspen and white birch. Considering the relatively young age of the forest, prior to 1943 the production of timber products in the state forest consisted only of the sale of fuelwood and timber salvage from blown-down trees. Management operations occurred to a limited extent during the late 1940s.

From 1944 until 1949 on the Northern Highland State Forest, a total of 3,207 acres were cut, yielding an average annual cut of 2,383 cords per year. In that same period, 552 total acres were cut on the American Legion State Forest for an average annual cut of 425 cords per year (WCD 1950).

As the forest matured, timber management became more significant to maintain the health of the forest and sustain it over time. As a result, the number of timber sales and the annual timber revenue climbed steadily through the 1950s and 1960s. The forests of aspen and birch were around the same age and reached harvestable age in the 1970s.

Management of the Northern Highland and American Legion State Forests also focused on recreational development to improve the facilities and opportunities for participation in outdoor recreation. In general, recreational development focused on campsites, picnic grounds, "bathing beaches," and other water-related activities of canoe routes and public access. Two principal hiking trail systems were laid out, but over the years, many of the trails fell into disuse and public use did not live up to expectations (WCD 1950).

The report further indicates that in the mid-to-late 1940s, camping as a principal form of outdoor recreation grew "phenomenally" on the Northern Highland and American Legion State Forests. Campsites were divided into two classifications: primary and secondary. Primary campsites were equipped with picnic tables, pit toilets, pumps, and in some cases, piers. Secondary campsites, also called wilderness campsites, were mainly located on canoe routes, islands or remote lakeshores inaccessible by automobile. No effort was made to provide formal camping facilities at these sites.

Prior to 1967, game management was treated separately from recreational development as a cooperative effort between the Game Division and Forests and Parks Division. No definite projects or detailed game management techniques were included. In general, managing for maximum recreational and scenic attractions plus maximum forest and game yields over time was encouraged.

After 1975, management for wildlife habitat and endangered resources were integrated with overall forest management activities. Since the 1982 NH-AL master plan was approved, management has continued to evolve based on new knowledge and policies related to state forests. Over the years, foresters incorporated management techniques including forest reconnaissance mapping, Big Tree Silviculture, and the WDNR Habitat Classification System. Management also addressed outdoor recreation and aesthetic practices as interest in those needs increased.

OVERVIEW OF CURRENT STATE FOREST USE AND MANAGEMENT

Current land management of the NH-AL reflects an integrated approach and considers the needs of all resource elements and their uses. Management actions account for forest stands and conditions, aesthetics, water quality, aquatic and terrestrial wildlife habitat, forest products, native biological diversity, resource protection, and recreation.

Many land management practices are also designed to support natural processes by simulating some aspects of the natural disturbance caused by fire through timber harvest, planting, soil disturbance, and other methods. For some areas, no active or passive management is used to protect or perpetuate certain habitats. The use of aesthetic management practices, particularly along roadways and shorelines, is a common element of timber harvesting. Water resource management objectives aim to maintain the high water quality, scenic beauty, and diverse habitats provided by the NH-AL's extensive lakes and streams.

The forest is managed for a variety of habitat and ecological goals that result in the production of valuable forest products. The annual production of forest products on the NH-AL averages over 40,000 cords and 2 million board feet. About 20% of the forest (43,848 acres) ranges from no management to reduced or modified management practices. These are lands classified in the 1982 plan as wilderness areas, wilderness lakes, wild areas, wild lakes, public use natural areas, scientific areas, and scenic areas.

Recreation is an important component of current management and use of the NH-AL. With over 225,000 acres, 900 lakes, and hundreds of miles of streams and rivers, it is the state's largest and most visited property.

Ojibwe tribes with treaty-reserved rights continue to hunt, fish and gather within the NH-AL boundaries.

People are drawn to the forest for many different recreational opportunities. The NH-AL offers a wide variety of water-based activities and a range of camping experiences. There are more than 900 total campsites. This includes remote canoe and backpacking sites and modern sites that feature showers and flush toilets. Year-round visitors use the designated trail

system for hiking, mountain biking, cross-country skiing and snowmobiling. Hundreds of miles of logging roads and non-designated trails are also open for all types of non-motorized uses.

The NH-AL offers numerous hunting opportunities. Each fall the state forest draws hunters from across the state and region for gun and archery deer hunting, as well as hunting ruffed grouse, woodcock, and waterfowl.

Another important offering is remote, non-motorized recreational activities. Currently, the remote, non-motorized recreation lands on the NH-AL include the 5,400-acre Manitowish Wilderness Area, and nearly 27,900 acres of wild areas with timber management, but limited motor vehicle access. The NH-AL also has 19 wilderness lakes and 41 wild lakes, which are quite rare regionally, and are highly popular for their remote, backpack and canoe campsites. These wild lands and lakes are sought by hikers, hunters, canoeists, and wildlife viewers who desire quiet, more pristine "backcountry" experiences.

Whether camping or staying in a resort or vacation home, visitors have long considered the NH-AL and nearby tourist service area a major vacation destination area. The NH-AL offers visitors an exceptional combination of scenic undeveloped forests, lakes, streams and bogs, along with a full range of quality outdoor recreational opportunities in a readily accessible location. Management of the state forest reflects the multiple benefits provided.

LAND OWNERSHIP

In a regional context, the NH-AL State Forest sits amid numerous other public lands in north central Wisconsin. The major public land ownership includes the Chequamegon and Nicolet National Forests, county forests, and other state-owned lands such as the Willow Flowage Scenic Waters Area and Turtle Flowage Scenic Waters Area. Private lands in the area include industrial forests, non-industrial private forests and tribal lands, including the Lac Du Flambeau Indian Reservation adjacent to the NH-AL.

Total acreage within the NH-AL boundary is approximately 345,000 acres, and covers parts of three counties (Vilas, Oneida and Iron) and 14 townships. This acreage includes approximately 48,000 acres of surface water (in over 900 lakes). The acquisition goal for the Forest is 226,200 acres; currently the state owns 99 percent of this goal, about 225,000 acres. A significant proportion of the private ownership within the NH-AL occurs around the lakes. This is especially true for large lakes of over 100 acres.

Primary uses of the lands of the region include recreation, timber production, limited agriculture (cranberry and wild rice production), and residential and tourism development. Private lands within and around the state forest are experiencing increasing development pressures, especially on lake and stream shores. Increased development pressure also increases the demand for property, thus raising property values and making it difficult to purchase additional public land.

ECOLOGICAL CAPABILITIES MAJOR ECOLOGICAL LANDSCAPES

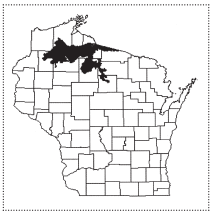
The National Hierarchical Framework of Ecological Units (NHFEU) classification system describes the overall ecological characteristics of the NH-AL. This system provides a basis for assessing resource conditions and capabilities at multiple levels.

All the lands within these units have similar ecological characteristics that are formed by such things as climate, soils, geology, relief, and natural disturbance history. The NH-AL is primarily in the NHFEU Sub-section 212Jm, Northern Highland Pitted Outwash. A small amount of the northwestern edge of the NH-AL lies in Subsection 212Jc, Winegar Moraines Subsection. This regional information is important because it defines how the capabilities of the NH-AL differ from other large public lands such as county and national forests in northern Wisconsin.

(Please refer to for the *Ecological Landscapes of Northern WI* p3-2 Shaping the Future binder).

Subsection 212 Jm. Significant ecological resources on the NH-AL State Forest that occur in Subsection 212Jm (Northern Highland Pitted Outwash) include high densities of kettle lakes, the headwaters for many major streams, large open acid peatlands and sedge meadows, and extensive dry forest types. Currently, the NH-AL forest contains a high density and composition of aspen and is important for species that utilize saplings and young upland deciduous forest as habitat. At the subsection level, there is considerable potential for large-block management since the forests are only moderately fragmented and connections might be made with the Nicolet-Chequamegon and Ottawa National Forests. Within the subsection, in high density lake areas, the shoreline is highly developed with second homes and roads that make much of this area unsuitable for species that require large unfragmented blocks of habitat, such as the wolf. The area holds high management potential for a variety of neotropical migrant birds, bald eagles, ospreys, common loons, and aquatic features. Habitats most in need of management attention are lakes, mature upland conifers,

mature upland mixed coniferous-deciduous forests, mature and sapling upland deciduous forests, sedge meadows, and bogs. Species in need of management attention include the mudpuppy in lakes; Connecticut and Blackburnian warbler in mature upland conifers; black-throated blue warbler and four-toed salamander in mature deciduous forests; northern goshawk in mature upland mixed forests; star-nosed mole in open lowland conifers; golden-winged and chestnut-sided warbler and pygmy shrew in deciduous saplings.



Subsection 212Jc. A small portion of the NH-AL State Forest is located in Subsection 212Jc (Winegar Moraines). Significant ecological resources that occur in this subsection are large wetlands including forested, shrub, and herbaceous types, as well as bogs. Kettle lakes are quite common but are often acidic and low in nutrients. Many cedar swamps exist that are important as deer wintering yards. Uplands contain mesic hardwood forest communities that have been fragmented by intensive forest management. However, the potential to manage for forest interior species occurs here because the matrix is primarily comprised of forests. This area may be suitable for wolf management because of the low density of roads and lack of human development. Given current land management, this area is important for species requiring sapling and young upland deciduous forest habitats. Habitats most at risk or in need of management attention are mature upland deciduous forests, marshes, mature lowland deciduous forests, closed lowland conifers, and shrub habitats. Species in need of management attention in this subsection are the Canada warbler and arctic shrew in closed lowland conifers; black-throated blue warbler and four-toed salamander in mature upland deciduous forest; northern goshawk in mature upland mixed forests; star-nosed mole in open lowland conifers; golden-winged warbler and pygmy shrew in shrub swamps.

A more detailed discussion of the ecology of the NH-AL and surrounding region may be found in the *Regional Ecology Wisconsin Northern State Forest Assessment, March, 1999*.

ECOLOGICAL ZONES OF THE NH-AL

For planning purposes, the NH-AL's two primary ecological landscapes, the Winegar Moraines Sub-section and the Northern Highland Pitted Outwash Sub-section discussed above, were further divided into smaller ecological zones.

NATURAL DISTURBANCES—A STRONG FORCE IN SHAPING THE NH-AL'S HISTORICAL VEGETATIVE LANDSCAPE

Prior to the extensive removal of timber in the Northern Highland Ecological Landscape, the location and age of the majority forest stands was mostly a result of the complex natural interactions. Fire occurred as both high intensity stand-replacement fires that killed the canopy trees and as lower intensity fires that burned under the trees modifying the structure and composition of the shrub and ground layer species. Windthrow from large storms (downbursts, ice storms and tornadoes) toppled many trees, especially large old trees, in their path. Insect outbreaks attacked many tree species, but were especially prominent on jack pine and balsam fir stands older than 50 years. Drought patterns reoccurred every 10 to 12 years. When the drought years coincide with the other forces, exceptional landscape changes in forest structure can occur.

Relationships exist between fire patterns, forest communities, and landscape patterns. The location, size, shape, and compass alignment of lakes and streams along with the abundance and location of islands influenced fire patterns. The fires also entered wetlands, which in a similar pattern were affected by size, shape, and alignment.

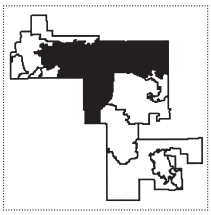
The combined effects of the above events shaped a landscape of varying tree composition and ages of stands. The average interval of stand replacement fires favored different tree species.

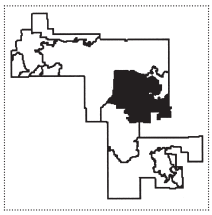
- The landscape was open or dominated by barren species (oak grubs), scattered jack pine groves and individual red pine trees for less than 60 or 70 years,.
- Jack pine forest, which included aspen, birch and groves of red pine was promoted by forest conditions for 70 to 120 years.
- Red pine forests with numerous pockets of white pine, aspen, and paper birch were favored by conditions for 120 to 150 years.
- White pine, red pine, red oaks and numerous groves of aspen and white birch accompanying the pines were favored by 150 to 250 years..
- 250+ favored development of a White pine, yellow birch, and eastern hemlock forest development were favored for 250+ years. Aspen and paper birch were limited to ridge tops and wetland edges.

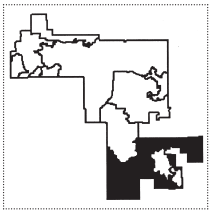
The division is based on local differences in soils, topography, vegetation, pre-settlement and current conditions, and other data. (Note: These ecological zones are not part of the National Hierarchical Framework of Ecological Units (NHFEU) classification system.)

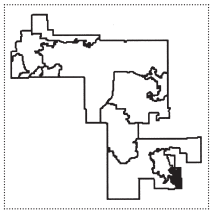
The ecological capabilities of these zones provide the framework for understanding the forest type or natural community a specific area can produce and what it does best. In other words, these ecological zones highlight ecological potentials for different parts of the NH-AL. The following ecological zone descriptions also give an overview of the land resources of the NH-AL. The acreages listed includes all land, both public and private.

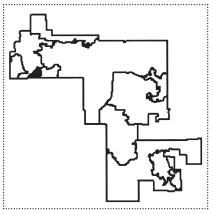
Vilas/Oneida Sandy Plains


Vilas Sandy Plains North


Vilas Sandy Plains Central


Oneida Sandy Plains


Stone Lake Ruffed Grouse Area


Sherman Lake Ruffed Grouse Area

The Vilas/Oneida Sandy Plains covers 148,800 acres or 66 percent of the NH-AL, and is by far the most dominant ecological zone on the forest. This zone showcases the forest's most common characteristics, the rolling (pitted outwash) topography peppered with abundant lakes and wetlands, and highly sandy soils.

Historically, fire was a significant factor here, as the soils are excessively well-drained sands that tend to produce very dry, fire-prone conditions. Forest stand-replacing fires occurred in 50- to 200-year cycles, but some trees survived to live over 300 years. Also, some fires burned along the ground, without killing the larger pines. This created a more open forest condition that is generally not seen today.

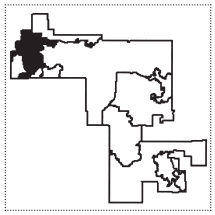
Before Northern Wisconsin was settled by Europeans, this zone was mostly covered with white and red pine stands, with white birch and aspen found secondarily across the zone. Some patches of jack pine and northern hardwoods were also present. The forested wetlands in this zone were tamarack historically, with black spruce being common and hemlock a minor species.

Today, aspen dominates this zone with white birch, red oak, and red pine mixed in at significant amounts as well. Those sites with slightly richer soils, such as in the Trout Lake area, have a higher oak component. Overall, the vegetation can be described as a varied "patchwork" of large and small patches of different timber types common to this zone.

The habitat types in this zone are typically characterized by an understory of shrubs such as hazelnut, juneberry, low sweet blueberry, sweetfern, and maple-leaf viburnum, and herbs such as wild lily-of-the-valley, bracken fern, grasses and sedges, and big leaf aster.

Based on the zone's ecological capability of its current forest conditions, the best management opportunities for this zone lie in increasing the pine acreage over time. The use of regeneration cuts to encourage aspen, white birch and jack pine would simulate some of the natural disturbance that fire created in the past. Some fire use may be incorporated into management.

Manitowish Peatlands



The Manitowish Peatlands include approximately 25,650 acres, which represents 11 percent of the land within the NH-AL boundary. It is one of Wisconsin's largest peatlands. The topography is nearly level throughout. It is characterized by large expanses of lowland communities, including open bog, poor fen, black spruce, swamp hardwoods and tamarack, much as it was before European settlement.

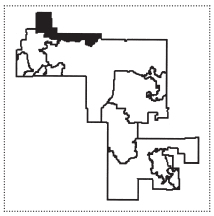
Many of the lowland zones contain sandy "islands" that are forested mainly with scattered red, white and jack pine. Soils are mostly very poorly drained organic peat. Some areas have sandy and loamy sand soils. Historically, both fire and floods, with the water table rising in wet years and dropping in drought years, were the major influences to the vegetation.

Prior to European settlement, the northern portion of uplands were dominated by hemlock, white birch, and white pine, while uplands areas to the south were dominated by red pine, white pine, and aspen. Within the forested wetlands, tama-

rack was predominant, with black spruce, swamp hardwoods and white cedar forest also present in significant numbers.

Today, this zone is a matrix of different tree species and natural communities. Unforested wetlands dominate half of the zone. Forested wetlands such as tamarack and black spruce are scattered across the landscape. Aspen, white birch, red pine and white pine are found in significant amounts on the uplands. There are also areas of northern hardwoods and hemlock-hardwoods. Most stands are a mixed mosaic of tree species. Management today has the opportunity to protect the habitat and rare species that prefer it.

Winegar Moraines



The loamy soils and Northern hardwood and hemlock-hardwood forests are uncommon within the NH-AL. The topography of the 10,000-acre Winegar Moraines zone is predominantly rolling, with abundant wetlands and many lakes. This zone covers 4 percent of the state forest.

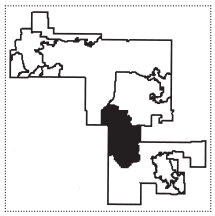
Soils are mostly well-drained sandy loams, silt loams and organic deposits. Historically in this zone, wind was the dominant disturbance factor in the older forest. Blowdowns of individuals and small groups of trees were frequent, while blowdowns of larger patches were infrequent. Catastrophic fires were extremely rare here, in sharp contrast to the drier, sandier soil areas.

At the time of European settlement, the uplands were mostly covered with hemlock and yellow birch, with sugar maple as a secondary species. The drier sites in the zone included white birch and white pine with secondary aspen, red pine, yellow birch and sugar maple. Within the forested wetlands, tamaracks dominate, with black spruce secondary. Today's upland forest contains both aspen and northern hardwoods stands. There are also areas of hemlock-hardwoods, white birch, and black spruce forest, and unforested wetlands.

The habitat types in this zone are characterized by herbs such as wild lily-of-the-valley, lady fern, shield fern, grasses and sedges, and big leaf aster, with a poorly developed shrub layer.

This zone offers an opportunity to restore hemlock and yellow birch. The dominance of eastern hemlock or sugar maple would have to be developed with selective thinnings in the northern hardwood type. Yellow birch is present in the stands, and with some gaps created in the forest stands it potentially could become a greater component in the future.

Big Arbor Vitae Loamy Hills



This zone represents 25,000 acres, about 11 percent of the NH-AL. It has varied topography and an assortment of different forest types. Lakes are common but lowlands, while certainly present, are not as widespread as in other zones on the NH-AL. At a large scale, this is one of the more ecologically intact forested portions of the NH-AL. Many of the white and red pine and northern hardwoods stands possess or are developing old-growth characteristics.

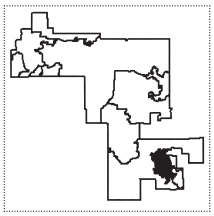
Fire was a significant disturbance factor within this zone's history, as it was across almost all the state forest. Windthrow was and still is another important disturbance factor, especially in areas with wetter soils. Sporadic wind events also occurred on drier upland sites as well and played a vital role in shaping forest succession. At European settlement, the upland areas contained several different forest types including northern hardwoods, hemlock-hardwoods, white and red pine, and even some jack pine/scrub oak. White birch, red maple, aspen and oak were found secondarily across the region. Within the forested wetlands, tamarack and black spruce were predominant, with some scattered cedar.

Today the zone's forest is characterized by a mixed matrix of tree species with northern hardwoods, aspen, oak and white birch dominant on the uplands but slowly being replaced by white pine, balsam fir and red maple through succession. There are some areas of mature red and white pine also, and these species are found extensively throughout the zone as important secondary species. While there are significant northern hardwood areas, hemlock-hardwoods are relatively scarce.

The habitat types in this zone are typically characterized by a moderately developed shrub layer of hazelnut, low sweet blueberry, juneberry, and maple-leaf viburnum, and herbs such as wild lily-of-the-valley, bracken fern, grasses and sedges, and big leaf aster.

The ecological capability of this zone offers the opportunity to restore the white pine, white birch and the northern hardwood species (red oak, yellow birch, sugar maple and eastern hemlock). Harvests that encourage the shade-loving species include thinnings and gap openings. To perpetuate stands of white birch and oak, significantly more open management harvests, including clearcuts, would be necessary in those areas.

Rainbow Wetlands (Big Swamp)



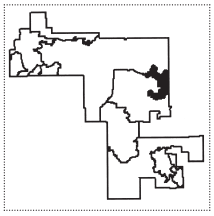
This 8,300 acre zone (4 percent of the NH-AL) is characterized by peat or wet, organic soils covered by large expanses of open bog, northern sedge meadow, shrub swamp, open bog, and muskeg. Scattered, low sandy ridges and islands covered with mixed aspen/pine forest punctuate this peatland landscape. A mature red and white pine forest covers some of the adjacent uplands.

Like nearly all of the NH-AL, fire was the dominant natural disturbance factor in this zone. Wind-throw, as well, was and continues to be a major influence due to the shallow root systems of trees in high water-table areas.

At European settlement, white pine, red pine, and white birch were the predominant upland trees. Aspen, yellow birch, and hemlock were found here secondarily. Within the forested wetlands, tamarack and black spruce were predominant, with white cedar present as a secondary component. This zone continues to be a patchwork of different tree species and communities. Today, lowland types dominate most of the zone, with aspen, white birch, jack pine, red pine and white pine found in significant amounts on the uplands.

Based on the zone's ecological capability, the most suitable management opportunities include continued protection of the wetlands and management of the uplands for a combination of white and red pine, aspen, and white birch.

Laura Lake Loamy Hills



The Laura Lake Loamy Hills ecological management zone covers approximately 7,400 acres, or 3 percent of the NH-AL. The land has a rolling to hilly topography. The zone's mostly well drained sandy loam soils are the richest soils on the forest, except for the Winegar Moraine zone, and it supports a mixed forest of sugar maple, basswood, aspen, yellow birch, and hemlock forests that is at or approaching mature forest conditions. Loamy sands and organic deposits also are common across the zone.

Historically, fire was the major disturbance factor. Stand replacing fires probably had 100-300 year cycles. Wind was a factor in disturbance in the older forest, especially where the local landscape was more moist and protected.

At European settlement, the upland areas were mostly covered with white pine, white birch and yellow birch. Aspen, red pine and sugar maple were the important secondary species. Within the forested wetlands, tamarack and spruce predominate, with hemlock, white pine and jack pine secondary. Today, the upland forests are dominated by old-growth northern hardwoods and hemlock-hardwoods, with aspen, red oak, and white birch.

The habitat types in this zone are typically characterized by a moderately developed understory of shrubs such as hazelnut, maple-leaf viburnum, and low sweet blueberry, and herbs such as wild lily-of-the-valley, bracken fern, grasses and sedges, and big leaf aster. Small, forested wetlands of tamarack, black spruce and white cedar are also found here.

The ecological capabilities of the richer soils here favor continuing the present day management trends, management to increase the white pine and yellow birch to establish a forest with the composition and characteristics of a late-successional forest. The diversity of age classes can be increased through selective harvests and gap openings. On appropriate sites, the hemlock that is present could be maintained and expanded.

OVERVIEW OF CURRENT VEGETATION OF THE NH-AL

The current vegetation of the NH-AL can be described in more detail by examining the plant communities or forest types that are present. The composition of the plant communities present today on the NH-AL and their distribution across the forest is a reflection of the land's ecological capability, as discussed earlier, and the management and natural disturbance history of the forest.

Sand-based soils and plant communities that do well on these sandy soils dominate the NH-AL. Loamy soils and the plant communities that thrive on these loamy soils are uncommon. Twenty-nine terrestrial and wetland plant communities were identified on the NH-AL. Table 3.1 lists the natural plant communities, which include 11 upland forest, 7 lowland forest, 7 lowland non-forest, and 4 upland non-forest communities. In addition, 6 aquatic and 3 miscellaneous categories were recognized (Eckstein et al. 2001).

(Please refer to Appendix 4 Map 1: Natural Community Distribution - CROG p.80,)

Several community types express major ecological themes of the NH-AL landscape. The NH-AL includes some of Wisconsin's least disturbed remnants of white and red pine communities. The hemlock-sugar maple-yellow birch forests on the NH-AL are among some of the largest such remnants on state land. A number of specialized plants and animals occur in the peatlands of the NH-AL, while wild rice marshes, no longer common throughout Wisconsin, are found on and around the property. The NH-AL contains a diverse array of aquatic features, including seepage lakes, drainage lakes, spring lakes, spring ponds, small streams, and selected

stretches of medium-size streams, such as the Manitowish and Wisconsin Rivers.

Upland communities account for approximately 72 percent coverage of the public land within the NH-AL property boundary; forested and non-forested wetland coverage accounts for around 23 percent (refer to Hydrology section for discussion of wetlands)1. In comparing the current forest cover for the NH-AL to the larger northern Wisconsin region, the proportion of northern hardwoods is smaller for the NH-AL and the proportion of both aspen and pines is larger.

The character of the current forest cover on the NH-AL is in part explained by looking at soil types and forest management practices. As discussed previously in the ecological landscape section, the drier and lower nutrient soils of the Northern Highland Pitted Outwash are more ideal for forest communities dominated by red pine, white pine, jack pine, red oak, and paper (white) birch. The prevalence of aspen, a young forest species, is a result of turn-of-the-century logging and fire, and forest management practices of the past decade. Figure 5.1 illustrates the acres of plant communities on state-owned land in the NH-AL.

MAJOR COMMUNITIES OF THE NH-AL

Aspen Community: The aspen community is found throughout the NH-AL and dominates the landscape in many areas. Aspen trees occur as associates in almost all of the other upland forest communities on the NH-AL. While the aspen timber type covers about 33.7 percent of the NH-AL, it occupies nearly 50 percent of the area available for active management. Because of the practice of Big Tree Silviculture[2], most aspen stands contain scattered individuals and clumps of mature white pine, red pine, and red oak.

White Pine and Red Pine Communities: While communities dominated by white pine (3.3 percent) and red pine (7.4 percent) make up about 11 percent of the NH-AL, these two tree species are found as very common associates throughout the upland forests of the NH-AL. For the last 25 years, the NH-AL has applied Big Tree Silviculture when managing forest stands. As a result, mature white and red pines occur throughout the NH-AL as individuals or as small clumps in most aspen, white birch, red oak, and northern hardwood communities. As illustrated in figure 3.1, those communities dominated by red pine total 15,964 acres (8,427 acres in plantations). Those communities dominated by white pine total 7,137 acres (588 acres in plantations).

Northern Hardwood and Hemlock-Hardwood Communities: Northern hardwood forests make up about 7 percent of the NH-AL and hemlock-hardwood forests make up about 1.5 percent. Three general areas on the NH-AL have soils with enough nutrients and moisture to allow the growth of northern hardwoods. One location is on the Winegar Moraine in the far north and northwest portions of the NH-AL. Another location is just east of Star Lake, and the third location is just north of Big Arbor Vitae Lake. Most northern hardwood communities are 80 to 90 years old and are very slowly increasing as some aspen stands are converted to northern hardwoods.

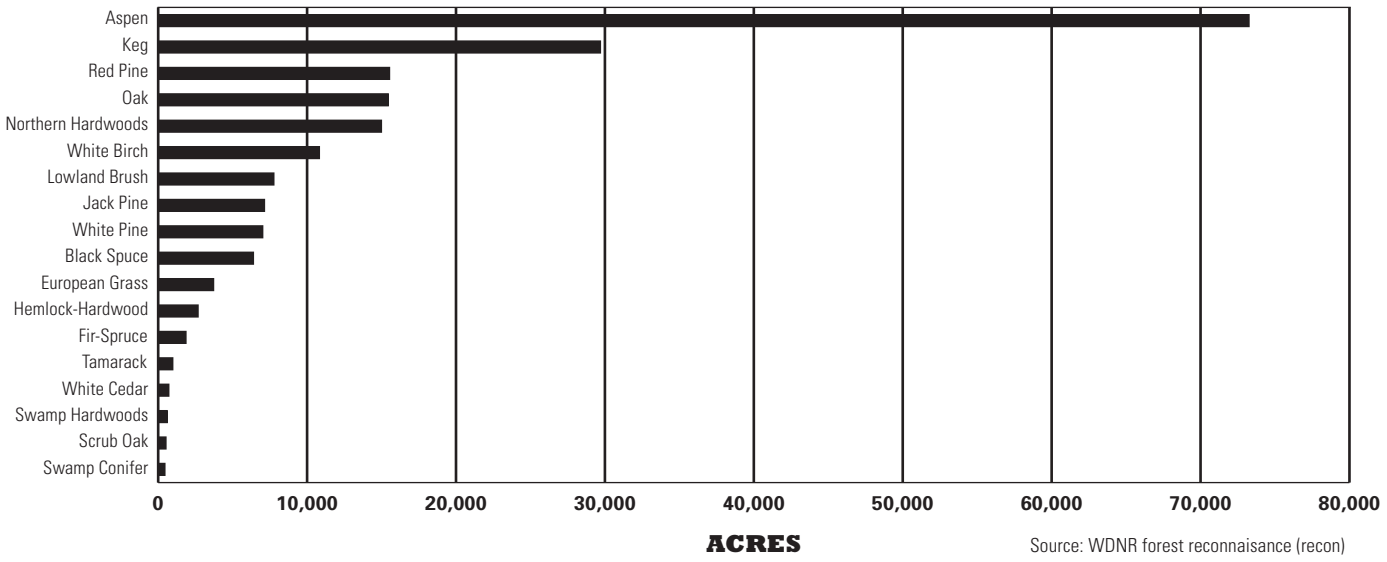
Table 3.1 Natural Plant Communities on the NH-AL

Upland Forest	Upland Non-forest	Lowland Forest	Lowland Non-forest	Aquatic	Misc.
Jack Pine	Pine Barrens	Swamp Conifer (fir)	Lowland Brush	Ephemeral Pond	Unclassified
Red Pine	Bracken Grasslands	Black Spruce	Alder Thicket	Emergent Aquatic	Developed
White Pine	Upland Brush/ European Grass	Tamarack	Shrub-Carr	Interior Beach	Private
Aspen	Bedrock Glade	Northern White Cedar	Keg	Submergent Aquatic	
White Birch		Swamp Hardwoods	Muskeg	Aquatic	
Scrub Oak		Bottomland Hardwoods	Poor Fen	Wild Rice Marsh	
Red Oak		Forested Seep	Open Bog		
Red Maple			Northern Sedge Meadow		
Northern Hardwoods			Boreal Rich Fen		
Hemlock-Hardwoods					
Fir-Spruce					

From WDNR Cover Types and Natural Heritage Inventory Communities.

[2] Since 1974, WDNR's State Forests have been mandated to use Big Tree Silviculture (BTS). Using this policy, NH-AL forestry staff reserved many individual white pine, red pine, sugar maple, eastern hemlock, and red oak trees when conducting clearcut and selective cut timber sales. Because of BTS, the current landscape on the sandy soils on the NH-AL is dominated by young aspen forest with a good mixture of 80-120-year-old white pine, red pine, and red oak.

Figure 3.2 Plant Community Types on State-owned Lands in the NH-AL.



Source: WDNR Forest Reconnaissance. The remaining percentage is classified as "miscellaneous" and includes areas "that are either unclassified in the RECON database, such as aesthetic buffers, or occur in rare community types that make up only a fraction of a percent," Eckstein et al. 2001.

Eastern hemlock occurs on the NH-AL as small stands in scattered locations. Logging and fires eliminated most of the eastern hemlock many years ago. The best stands include the former State Trust Lands that escaped the turn-of-the-century logging. Some of these eastern hemlock stands are the oldest forest communities on the NH-AL.

Red Oak Community: Red oak communities make up 7 percent of the NH-AL. Red oak trees are associated with many of the pine, aspen, white birch, and northern hardwood communities on the NH-AL. Most stands are about 80 to 90 years old. The NH-AL's red oak forests are some of the most extensive in the region (i.e., Laurentian Mixed Forest, Province 212).

Jack Pine Community: Jack pine communities make up about 3.5 percent (7,484 acres) of the NH-AL. About 58 percent of jack pine stands are of plantation origin. The largest area of jack pine occurs on very sandy soils in the Boulder Junction area and is of plantation origin. Small stands occur in scattered areas throughout the NH-AL. Small islands of jack pine occur in the Rainbow Flowage peatlands and a wet variant of the jack pine community occurs along Highway 51 just northwest of CTH H.

Large Peatlands: Two large peatlands are found on and near the NH-AL. One includes the Powell Marsh State Wildlife Area and adjacent NH-AL lands. The other is located east (Rainbow Sedge Meadow) and south (Big Swamp) of the Rainbow Flowage. These peatlands are regionally significant habitat areas.

Opportunities for Landscape-scale Management: The Northern Highland-American Legion State Forest is the largest state property. Three National Forests (the Chequamegon, Nicolet, and Ottawa) are very close to its boundaries (but occur on very different landscape types), as are several county forests, intensively managed but undeveloped industrial forests, and a large tribal reservation. Other state lands (e.g., State Wildlife Areas, State Trust Lands, SNAs) are scattered throughout the region. The NH-AL State Forest is the best location in the state of Wisconsin to manage for a major pinery at a large scale, featuring extensive forests that are dominated by white pine and red pine, with associated hardwoods such as red oak, red maple, and paper birch. Representation of missing or diminished successional stages and patch sizes for pine-dominated and other forest communities is not only possible but feasible here, a situation that is matched at few, if any, other locations in the state. Both natural processes and restoration techniques can be used to re-establish the pinery.

Table 3.3 Age of Forested Plant Communities

Age Class (years)	Percent of state owned land open to active management in each age class
1 to 40	44%
41 to 80	22%
81 to 120	31%
120 +	3%

Eckstein et al. 2001.

The property also contains one of the upper Midwest's greatest concentrations of glacial kettle lakes, an abundance of diverse wetlands and streams, excellent examples of less common or well-represented natural communities, and many populations of rare plants and animals.

OPPORTUNITIES TO RESTORE NATIVE COMMUNITIES AND OLD-GROWTH FOREST

Table 3.2 indicates the relatively young age of the NH-AL's forests. About 85 percent of the aspen stands are less than 40 years old. About 50 percent of the red and 60 percent of the jack pine stands are of plantation origin.

Overall, 97 percent of the NH-AL's actively managed forest is distributed between young, intermediate, and mature forest. Less than 3 percent of the actively managed forest is older growth—more than 120 years in age. The oldest forest includes various scattered hemlock-hardwood, northern white cedar, and white pine communities.

The drier upland habitats areas that cover most of the NH-AL (i.e., the Northern Highland Pitted Outwash Ecological Landscape) have the ecological capability to support red, white, and jack pine, aspen, white birch, and red oak, along with northern hardwoods on a few richer sites. The NH-AL represents the best opportunity in the region to restore large areas of red and white pine-dominated forest while maintaining a mix of aspen, white birch, red oak, and jack pine. Opportunities exist for developing old-growth forest in selected areas of white pine, red pine, hemlock-hardwood, northern hardwoods and red oak. The NH-AL uplands also offer opportunities to manage some areas for old-growth forest characteristics and protect diverse communities of plants and animals (refer to Eckstein et al. 2001 for ranking and identification of 52 old-growth site candidates).

WATER RESOURCES

The NH-AL State Forest and surrounding area contains a concentration of lakes that is higher than anywhere else in northern Wisconsin. The area, known as one of the most concentrated lake districts in the world, has the largest number of "kettle lakes," which formed in the deep pits left by blocks of melting glacial ice. The NH-AL contains over 900 lakes within its boundaries, over 6 percent of Wisconsin's total, while the NH-AL land area is barely 0.5 percent of Wisconsin's total land base. Extensive bogs and swamps that formed in poorly drained depressions cover about 21 percent of the Northern Highlands Region (i.e., the NH-AL and the adjacent area with similar geologic landscape). The region is an important headwater area for much of Wisconsin because of its relatively high elevation, great infiltration capacity, and mostly forested watershed.

The lakes and streams in the NH-AL are treasured for their high water quality and provide a variety of habitats, supporting diverse fish, amphibian, invertebrate, and plant communities, with many rare species. The majority of rare plants and animals on the NH-AL were identified in wet habitats. The NH-AL holds the state's largest known populations and large portions of the total number of populations of many aquatic plants. The NH-AL contributes to one of the highest known regional concentrations of bald eagle, osprey, and common loon, which depend on open lakes and rivers. The NH-AL is also fast becoming one of the last places in the state with large undeveloped lakes.

LAKES

The Northern Highlands Region has one of the highest concentrations of kettle lakes in the world. Lakes cover over 12 percent of the surface of the NH-AL State Forest. Lakes can be classified by their hydrology into four main groups. Each provides different aquatic habitats.

- Seepage – landlocked with no surface inlets or outlets
- Drainage – with surface inlet and outlet streams
- Drained – intermittent outlet, no inlet
- Spring – permanent outlet, no inlet

The majority of lakes on the NH-AL larger than 10 acres are seepage lakes. While less numerous, drainage lakes comprise 67% of the surface acreage in the NH-AL. The majority of lakes larger than 100 acres in size are drainage lakes. According to the Biotic Inventory (Epstein et al. 1999), the NH-AL presents exceptional opportunities to protect and manage a diverse array of aquatic habitats including seepage lakes, drainage lakes, spring lakes, spring ponds, small streams, and selected stretches of larger streams such as the Manitowish and Wisconsin Rivers.

One aquatic habitat, soft-water seepage lakes, are particularly diverse and well represented on the NH-AL. A special feature of the NH-AL's primary ecological landscape (Northern Highland Pitted Outwash) is the concentration of *very* soft seepage lakes. These lakes feature a unique aquatic community characterized by a number of aquatic plants that exhibit a sterile rosette growth form carpeting the lake bottom. A number of rare invertebrates are found in these lakes as well. Large, firm-bottomed lakes are common on the forest. The NH-AL offers perhaps the only opportunity to continue to protect these large lakes—a type facing especially strong development pressure in northern Wisconsin.

WETLANDS

Wetlands represent the vital transition between the dry habitats of the uplands and the surface waters of lakes and streams. A wide variety of wetland habitats are found on the forest including open bog, forested bog, sedge meadow,

emergent and submergent aquatic plants, hardwood swamp, white cedar swamp, and fen. Non-forested wetlands are much more common on NH-AL than are the forested wetlands, covering 16.7 percent and 4.2 percent of the NH-AL property, respectively.

NON-FORESTED WETLANDS

Most of the non-forested wetlands in the NH-AL are areas of open sphagnum moss, while some are lowland brush (i.e., alder thickets or wet meadows). These community types support many rare species and are valued for watershed protection. Unforested wetlands are typically stable, though some are succeeding to tamarack and black spruce.

The use of management tools, like prescribed burning and mechanical shearing, can be used when needed to maintain the open habitat, though most unforested wetlands are unmanaged.

The NH-AL offers the opportunity to protect wetland communities that are rare or representative in the region, or that are common and in need of protection from drainage and development. Seventy-nine percent of the rare plants documented on the NH-AL grow primarily in wet habitats, illustrating the biodiversity significance of abundant high-quality lakes, streams, and wetlands in the region. The NH-AL hosts many of Wisconsin's largest known populations of shore sedge, marsh willow-herb, and leafy white orchids. Rare bryophytes (mosses, liverworts) and lichens are also found on the NH-AL, the majority of them in wetland habitats. The high number of rare aquatic animals is also a reflection of the abundance of high-quality lakes, streams, and wetlands on the property. A suite of butterfly species including the bog copper is associated with peatlands. The yellow rail is one rare bird that lives in the NH-AL's unforested wetlands.

Extensive acreages of good quality acid peatlands on the NH-AL offer an opportunity for protection, as all of the larger sites within the region have been somewhat altered or compromised by various developments. The boreal fen is rare on the NH-AL and apparently uncommon throughout Wisconsin, but several excellent examples with unusually rich repositories of rare plants were identified on the forest. The northern sedge meadow is widespread in the region with several large, high quality occurrences along streams and lakeshores in the NH-AL (Epstein et al. 1999). Protection of the existing forested and unforested wetlands within the NH-AL is critical for maintaining the high quality of the region's lakes and streams.

Two wetland communities that are well represented on NH-AL, but relatively rare through the region, are wild rice marshes and inland beach communities. Wild rice marshes were identified by both the Biotic Inventory (Epstein et al. 1999) and CROG (Eckstein et al. 2001) as having a high opportunity for conservation. Emergent aquatic, submergent aquatic, and inland beach communities are widespread in northern Wisconsin, and have excellent occurrences on the NH-AL.

FORESTED WETLANDS

The forested wetlands of the NH-AL include black spruce, tamarack, northern white cedar, and swamp hardwoods habitats. Forested wetlands have high value for various wildlife species such as neotropical migrant birds, and rare species like the Yellow-Bellied Flycatcher. And, like non-forested wetlands, forested wetlands have high watershed protection value. Forested wetlands have slow plant succession and a low potential for the land to support other tree species.

In pre-European settlement forested wetlands, tamarack was by far the leading dominant tree with black spruce as a common associate. The peatland forests were cut at the turn of the century and have regenerated naturally, with a slow increase in tamarack in open areas. Over time, there has been a shift from tamarack to later-successional black spruce. Restoration of tamarack on some of the NH-AL's wetlands is one of the community restoration opportunities identified in the CROG Assessment and Biotic Inventory.

The northern white cedar forests are represented on the NH-AL in two exceptional, large, and diverse occurrences. The northern hardwood swamp (black ash) has one large occurrence and is naturally rare in Wisconsin.

The forested and unforested wetlands and aquatic habitats of the NH-AL represent highly significant opportunities for protection and management of rare and biologically diverse communities, restoration of pre-logging settlement wetland vegetation, and maintenance of wetland communities on the landscape level. The high density of lakes and the abundance of undeveloped lakes, is unique to the NH-AL State Forest and surrounding region. Few lakes outside of the NH-AL in this region have significant undeveloped shoreline and development continues to shrink the habitat that remains. The number of undeveloped, high quality lakes and wetlands within the NH-AL are unique in the region. They provide critical habitats for the species that depend on them.

[3] Includes total length of streams that cross the property.
[4] Outstanding Resource Waters (ORW) have the highest-quality water and fisheries in the state and deserve special protection.
[5] Exceptional Resource Waters (ERW) have excellent water quality and valued fisheries, but already receive existing wastewater discharges.

Table 3.4 Stream Classifications in the NH-AL

Existing Biological Use Classification

Number of Streams	Total Miles	WWFF Miles	WWSF Miles	Cold I Miles	Cold II Miles	Cold III Miles	Not Classified
126	338.5	20.0	142.7	12.9	28.9	4.0	130.0

Source: WDNR Shaping the Future binder 1999.

STREAMS

Within the NH-AL State Forest, there are 126 streams, comprising 338.5 stream miles[3]. Three streams are designated as Outstanding Resource Waters (ORW)[4]: Allequash Creek, Siphon Creek and Trout River. Four streams are designated as Exceptional Resource Waters (ERW)[5]: McGinnis, Mishonagon, Stella, and Plum Creeks. (Please refer to *NH-AL Surface Water Resources* map p.10-1a from Shaping the Future binder).

Streams can be further classified based on their "existing biological use," which is used to describe the current condition of the surface water in a stream, and the biological community (fish and other aquatic life) living in that surface water. Table 5.3 summarizes the streams and their classifications (Refer to WDNR Shaping the Future binder 1999 for listing of streams, total miles, and watershed location).

As noted in the Biotic Inventory (1999), most streams on the NH-AL are small, originating in or connecting lakes. They feature few rare species; however, they support excellent examples of macroinvertebrate communities dominated by filter feeding and collecting/gathering detritivores. Only portions of the Wisconsin and Manitowish Rivers represent larger non-wadeable streams on the forest. These two streams have a number of rare fish and invertebrates found nowhere else on the NH-AL. Spring ponds are characteristic of a small portion of the NH-AL and are generally the source of the dozen trout streams found here.

The primary detriment to habitat on NH-AL streams are dams. Dams have been constructed on the largest streams within the NH-AL—the Wisconsin and Manitowish Rivers. They have an adverse impact on the stream's biodiversity, especially affecting fish, mussels, and certain aquatic insects.

THE FISHERY

The uniquely abundant water resources in the state forest provide for a wide range of fish communities. This resource attracts a diverse group of anglers that play a major role in how these waters are managed. Native American treaty harvest rights also play a role. Management goals and activities for these waters vary by the type of water and angling potential. The waters in the forest can be divided into four major types: cool water lakes, warm water lakes, cool water streams, and cold water streams.

COOL WATER LAKES

Cool water lakes comprise the major water resource within the forest boundary. These lakes are typically infertile, greater than 200 acres, have clear or slightly stained water and a maximum depth of greater than 30 feet. The typical gamefish

DESCRIPTION OF EXISTING BIOLOGICAL USE CLASSIFICATIONS

WWFF: Warm Water Forage Fishery. Includes surface waters capable of supporting an abundant, diverse community of forage fish and other aquatic life.

WWFS: Warm Water Sport Fishery. Includes surface waters capable of supporting a community of warm water sport fish or serving as a spawning area for these fish.

Cold: Cold Water Community. Includes surface waters capable of supporting a community of cold water fish and other aquatic life or serving as a spawning area for cold water fish species.
Class I streams are high quality streams where populations are sustained by natural reproduction.
Class II streams have some natural reproduction but need stocking to maintain a desirable fishery.
Class III streams have no natural reproduction and require annual stocking of legal-size fish to provide sport fishing.

community in these lakes consists of walleye, muskellunge, northern pike, smallmouth bass, yellow perch, and black crappie. Other species of interest include cisco, redhorse, and white sucker. The unique lake trout and whitefish fishery of Trout Lake is also part of this lake type. Other examples of lakes in the NH-AL that are in this classification include: Papoose Lake (Vilas Co.), White Sand Lake (Vilas Co.), Plum Lake (Vilas Co.), and Lake Tomahawk (Oneida Co.). The vast majority of the waters in this group have adequate natural reproduction of the major game species. Stocking of muskellunge and walleye occurs on some of these waters that are suited to these species but have experienced recruitment problems. The Trout Lake strain of lake trout are also stocked into suitable lakes on the forest. This stocking program is designed to rehabilitate historic lake trout populations and provide future fishing opportunities. There are several small cool water lakes that are managed specifically for brook and/or brown trout. These waters are stocked to provide a put-grow-and-take fishery.

WARM WATER LAKES

There are numerous warm water lakes in the forest. These lakes are typically moderately fertile, less than 200 acres, and have a maximum depth of less than 30 feet. The fishery in most of these waters consists of bass and panfish. Some waters also have significant northern pike populations. These waters have simple fish communities compared to larger lakes in the area. These lakes have fewer habitat types, thus fewer fish species. Lakes that fit this classification include: North Bass Lake (Iron Co.), Stella Lake (Vilas Co.), Partridge Lake (Vilas Co.), Bittersweet Lake (Vilas Co.), and Miller Lake (Oneida Co.).

Almost all the waters in this group have adequate natural reproduction of the major game species. Stocking of muskellunge and walleye occurs on some of these waters to provide panfish control and angling opportunities. Few of these waters have naturally reproducing walleye or muskellunge fisheries.

COLD WATER STREAMS

Of all the waters in the forest, the cold water streams are the most limited. These waters have summer water temperatures that do not get above 70 degrees and have moderate flows. The fisheries present in most of these waters consist of brook and/or brown trout. The major waters in the forest that fit this designation are: Plum Creek (Vilas Co.), Stevenson Creek (Vilas Co.), and Mishonagon Creel (Vilas Co.).

The waters in this group have adequate natural reproduction of the major game species and are not stocked. Plum creek is currently the only exception in this group and is stocked with brown trout.

COOL WATER STREAMS

There are cool water streams scattered throughout the forest. Most of these waters have their origin at the outlets of lakes and in many cases connect two lakes. Due to a lack of significant ground water input these waters have summer water temperatures that get above 70 degrees regularly. These waters have moderate to low flows and are usually fertile. The fisheries present in most of these waters are typically the same as the waters they are connected to. Due to their high summer water temperatures they do not have trout in them. Representative waters in the forest that fit this classification are: Manitowish River (Vilas and Iron Co.), Trout River (Vilas Co.), and the Wisconsin River (Vilas and Oneida Co.).

None of these waters are currently stocked. The waters in this group have adequate natural reproduction or rely on the waters they are connected to for their fish populations. Little, if any, habitat work is conducted on these waters. There are several spring fish refuges on some of these streams.

HABITAT NEEDS

Losses of habitat and shoreline/bank development are common issues on all these waters. Management activities that enhance habitat such as tree drops, half logs and bank structures are important. These efforts should be applied where they are needed and will provide meaningful return to the fishery. Riparian shoreline and stream bank activities have a tremendous effect on the health of our fisheries. Efforts should be taken to promote buffer strips and shoreline restoration on all waters in the forest.

FISHING REGULATIONS

Controlling fish harvest through the use of lake- and stream-specific fishing regulations is the most effective tool in managing the fisheries on these waters. A variety of fishing regulations cover the waters in the NH-AL state forest. The types of fishing regulations that are currently in use include closed seasons, bag limits, and length restrictions.

Fishing regulations are set through a separate rule-making process, not by the master plan. The regulations review process involves the local fisheries biologist or warden, conservation congress, the DNR secretary, natural resources board, legislature and the governor. The public has opportunities to be involved at all the stages process.

RESEARCH ACTIVITIES

The abundant waters on the forest provide unique fisheries research opportunities. State and university sponsored studies that have meaningful management applications should be encouraged. These types of studies can provide insight into fisheries issues that will benefit waters well beyond the

boundaries of the state forest. Waters that currently have major ongoing fisheries studies include: Escanaba Lake (Vilas Co.), Pallette Lake (Vilas Co.), Nebish Lake (Vilas Co.), Mystery Lake (Vilas Co.), Spruce Lake (Vilas Co.), Little Rock Lake (Vilas Co.), Camp Lake (Vilas Co.), Bittersweet Lake (Vilas Co.), Smith Lake (Vilas Co.), Oberlin Lake (Vilas Co.), Prong Lake (Vilas Co.), Lake Trout Lake (Vilas Co.), and Sparkling Lake (Vilas Co.). Since the issues of significant management concern are always changing, other NH-AL waters may meet the requirements for future studies.

WILDLIFE

In general, the wildlife of the NH-AL is typical of the Upper Great Lakes Region. The NH-AL provides habitat to forest game species such as white-tailed deer, black bear, ruffed grouse, woodcock, snowshoe hare, red fox, and coyote. The aspen forest is the preferred habitat for these forest game species.

Characteristic birds of the NH-AL's forest habitats include broad-winged and sharp-shinned hawks, barred and saw-whet owls, downy and pileated woodpeckers, and a wide variety of songbirds. Wood turtle, northern ring-necked snake, and red-backed salamander are characteristic reptiles and amphibians.

Common mammals found in the NH-AL's lakes and wetlands include beaver, river otter, mink, and muskrat. The wood, frog, spring peeper, and eastern gray tree frog are common amphibians. Typical birds observed in these habitats include mallard, wood duck, black duck, hooded merganser, great blue heron, bald eagle, osprey, and common loon. The Mann, Stevenson, Ristow, and Bear Creek Flowages are managed for waterfowl. Existing wild rice beds are protected and several historic beds have been restored.

There are some wildlife features unique to the NH-AL and its immediate surroundings. The large number of lakes and wetlands provide habitat for the most concentrated populations of bald eagles, ospreys, common loons, and river otters anywhere in the region. Areas of mature upland conifer forest support a variety of songbird species including the black-burnian, black-throated green, and pine warblers and the red-breasted nuthatch. As documented in the Biotic Inventory (1999), the NH-AL occurs within a band of physiographic strata that supports the most species of breeding neotropical migrant birds north of Mexico.

CURRENT MANAGEMENT

Forestry and wildlife staff work together to insure wildlife habitat needs are met on all timber sales. Special attention is paid to management of red oak, aspen, hemlock, white pine, white cedar, snags, and den trees.

Currently there are 707 relic and 342 constructed wildlife openings on the NH-AL. Wildlife openings are generally 1 acre or smaller grassy areas; some are old homesteads or frost pockets while others were constructed during the 1980s.

Deer populations are managed for a population goal set for individual deer management units as part of a statewide process that is independent of the master plan. The current over-winter goals for the units within the NH-AL range from 12 to 25 deer per square mile of deer range.

RARE SPECIES

RARE ANIMALS

The NH-AL has 67 documented species of rare animals. These include one Wisconsin Endangered, nine Wisconsin Threatened, and 57 Wisconsin Special Concern species (refer to Epstein et al. 1999 for methodology, detailed information and lists of rare animals.). Of the 67 species, more than 75 percent dwell in wetland and aquatic sites. Only 19 (28 percent) occur on upland sites (difference in percentages is due to species occurring in more than one habitat).

Included in these 67 species are one US Endangered (timber wolf) and one US Threatened (bald eagle). As of 2004, a pack of four wolves live in the west part of the forest (Miles Lake Pack) and another pack of two occurs on the northeast side of the forest (Nineweb Lake Pack). Because of the large average size of wolf territories (from 20 to 120 miles), no pack territory is likely to be completely contained within the forest, and some areas of suitable habitat may not be fully occupied. Links to other surrounding properties from the NH-AL are important to maintain populations of timber wolf in the north central Wisconsin landscape.

The lakes of the NH-AL contribute significantly to one of the highest known regional concentrations of bald eagle, osprey, and common loon. All bald eagle, osprey, and great blue heron nests are protected. The NH-AL offers a significant opportunity to provide secure habitat for a large number of forest-dependent birds, including the northern goshawk (Wisconsin Special Concern), several boreal species, and many forest interior species.

RARE PLANTS

The Wisconsin Heritage Database lists 33 rare plant species on the NH-AL (refer to Epstein et al. 1999 for methodology, detailed information and lists of rare plant species and communities). Moor rush is listed as Endangered in Wisconsin, and Calypso orchid, shore sedge, and algae-like pondweed are listed as Threatened in Wisconsin. Seven of the 33 rare species grow on upland sites, 17 in wetlands, and nine in water.

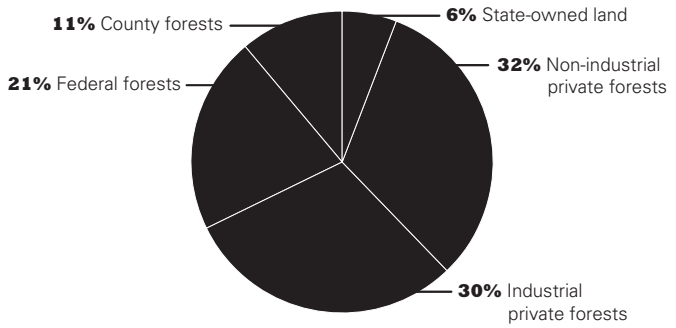
This high concentration of rare plants in aquatic habitats illustrates the significant biodiversity found in abundant high-quality lakes, streams, and wetlands in the Northern Highland region. Many of these habitats are vulnerable to invasion by aggressive exotic species such as purple loosestrife, reed canary grass, Eurasion water milfoil, and glossy buckthorn. Preventing the spread of these species would greatly aid the survival of rare aquatic and wetland species at NH-AL.

NH-AL provides excellent opportunities for assuring the viability of algae-like pondweed, shore sedge, Robbins spikerush, and American shoregrass in Wisconsin, claiming the state's largest known populations and large portions of the total populations in the state. In addition, NH-AL hosts many of Wisconsin's largest known populations of marsh willow-herb, leafy white orchid, hidden-fruited bladderwort, purple bladderwort, and northeastern bladderwort.

SOCIO-ECONOMICS

The socio-economics assessment for the NH-AL State Forest region documents the contribution of timber and recreation to the region's economy (Watkins et al. 1999)[6]. The assessment found that almost 30 percent of the regional output and 27 percent of the region's jobs are somehow tied to either wood products or tourism-sensitive sectors. In comparison, statewide estimates show that combined wood-products and tourism-sensitive sectors make up only 12 percent of state output and 18 percent of statewide jobs (refer to Watkins et al. 1999 for a more detailed socio-economics discussion).

Figure 3.2 Percent of Annual Timber Removals in the NH-AL Region by Ownership in 1996



In 1996, the average annual value of timber removals in this seven-county region was approximately $33 million. Figure 3.2 shows how this value is divided among five major groups of landowners. Industrial and non-industrial private landowners account for the majority of the region's annual timber removals. Of the $33 million, approximately $2 million (6 percent) was harvested from state properties. Over the four-year period (1992-1996), the NH-AL contributed 4.2 percent of the volume of timber harvested in the region.

Table 3.4 shows a breakdown of the timber and recreation revenue generated on the NH-AL from 1997-2001 (Gardner 2002)[7]. The timber revenues support the findings in the regional analysis (Rissman et al. 2002) that the NH-AL timber is important to local logging operations. However, the NH-AL does not play a major role in the regional wood products industry, given the relatively small proportion of regional

Table 3.5 NH-AL Annual Timber and Recreation Revenue, 1997-2001

Timber Revenue	**1997**	**1998**	**1999**	**2000**	**2001**
Logging Sales	1,167,991	1,575,760	1,746,974	2,055,514	1,480,156
Boughs	770	760	845	985	855
Christmas Trees	666	1,308	998	694	590
Fuelwood (firewood)	1,372	1,715	2,215	2,760	3,355
Miscellaneous		101	3,159	16,703	10,170
Sub-total	*1,170,799*	*1,579,644*	*1,754,191*	*2,076,656*	*1,495,126*
Recreation Revenue	**1997**	**1998**	**1999**	**2000**	**2001**
Camping	429,561	463,521	522,130	315,423	452,809
Admission stickers/passes	163,776	179,065	177,119	187,103	182,513
Miscellaneous	290	425	787	1,112	1,482
Sub-total	*593,627*	*643,011*	*700,036*	*503,638*	*636,804*
TOTAL REVENUE	**$1,764,426**	**$2,222,655**	**$2,454,227**	**$2,580,294**	**$2,131,930**

Source: Gardner, 2002

[6] This assessment defined the region as six Wisconsin counties (Iron, Forest, Lincoln, Oneida, Price and Vilas) and one Michigan county (Gogebic).

[7] It is important to note that not all revenue generated from timber or recreation on the NH-AL is kept by or budgeted to the NH-AL, but is deposited in a segregated account called the Forestry Account. These revenues are appropriated by the Wisconsin Legislature for a variety of statewide forestry-related programs.

timber volumes harvested from the NH-AL (roughly 4%) and the fluidity of timber flows within and outside the region. Although less significant than timber harvesting, the gathering and use of forest resources as a contributor to timber revenues illustrates the NH-AL's importance to specific local economies.

Table 3.4 also shows the recreation revenues generated on the NH-AL between 1997-2001. These figures indicate only a small portion of the total revenue generated by recreational visitors. The full economic contribution of NH-AL recreation reaches far beyond the forest campgrounds and trails to the many resorts, restaurants, service stations and other businesses in the area. However, considering only a portion of the area's tourism business revenue comes from forest-based recreation it cannot be quantified with existing data. Clearly though, the NH-AL is an important supporter of the local tourism-based economy.

POPULATION TRENDS

Data from the NH-AL Regional Analysis documents the accelerated rate of population increase in the NH-AL region compared to statewide numbers. Table 3.5 illustrates that Vilas and Oneida counties are experiencing the largest increases, the two main counties within which the NH-AL State Forest lies.

Note that these numbers do not include seasonal populations, which often far exceed resident populations. U.S. Census Bureau data (US DOC 2001) is useful in looking at the housing trends. Census information indicates that of the 22,397 total housing units in Vilas County in 2000, 12,587 or 56.2 percent are designated as vacant housing for "seasonal, recreational or occasional use." Similarly, seasonal housing in Oneida County accounts for 39.2 percent of the total housing units. In comparison, statewide numbers show only 6.1 percent of the total housing units are designated as vacant housing for seasonal, recreational or occasional use.

The increased demand for housing in the northwoods has caused a sharp increase in property values, outpacing the rest of the state. The Wisconsin Department of Revenue found that land values rose in a four-county study region (Iron, Oneida, Price, and Vilas Counties) an average of 15.5 percent between 1998 and 1999. Shoreland property is in particular demand.

Secondary impacts of increasing residential growth and tourism include more pressure on public lands to support outdoor nature-based recreation. The Minocqua-Woodruff area, located just outside the NH-AL's western border, is one of the most rapidly growing tourist areas in the state. New housing and tourist infrastructure development has been extremely rapid. Forest land is being divided into parcels, shorelands developed, wetlands removed and roads built and expanded. This trend focuses more intensive pressure on public land, and the centrally located and highly accessible NH-AL State Forest, in particular.

RECREATION FACILITIES

WATER RECREATION OPPORTUNITIES

With more than 900 lakes and 300 miles of streams, the NH-AL offers abundant, high quality water recreation opportunities. Please refer to the currnet boat landings and canoe map in the appendix.

Popular water-oriented recreation includes fishing, swimming, water skiing, boating, jet-skiing, canoeing, and sightseeing. The facilities on the forest supporting water recreation are nine designated swimming beaches, and more than 100 designated boat launch sites. The boat access sites range from well-developed, cement sites (73) to gravel and unimproved sites (233) to carry-in and canoe slide sites (9).

WILD RESOURCE RECREATION

The NH-AL offers a large number of natural lakes with undeveloped or mostly undeveloped shorelines, which are quite rare in the state. Most of the lands offering this special type of recreational opportunity are officially designated as wilderness lakes and wild lakes.

The NH-AL includes the 5,460-acre Manitowish River Wild Resource Area, which is a large roadless area closed to motor-

Table 3.6 Comparison of Census Results, March 2000

WI County	Census Population 2000	Population Change 1990-2000	% Change 1990-2000
Vilas	21,033	3,326	16%
Oneida	36,776	5,097	14%
Forest	10,024	1,248	12%
Iron	6,861	708	10%
Lincoln	29,641	2,648	9%
Price	15,822	222	1%
Regional Total	120,157	13,249	11%
Statewide	**5,363,675**	**471,906**	**9.6%**

Table 3.7 NH-AL State Forest Camping and Picnic Facilities

	Number of Sites	Reservable sites	Toilets: pit/flush	Drinking Water	Showers	Dump station	Firewood	Shelter	Swimming Area	Picnic Area	Fishing	Boat Landing	Handicap Accessible	Fee Required
Campgrounds:														
Big Lake	72		p	X			X				X	X		X
Crystal Lake	100	r	p/f	X	X	X	X	X	X	X	X	X	X	X
Big Muskie Lake	81	r	p/f	X	X	X	X	X	X	X	X	X	X	X
Firefly Lake	70	r	p/f	X	X						X	X	X	X
Plum Lake	18		p	X							X	X	X	X
Razorback Lake	55		p	X							X	X		X
East Star Lake	30		p	X							X	X		X
West Star Lake	18		p	X							X	X		X
Sandy Beach Lake	37		p	X						X	X	X		X
Starrett Lake	46		p	X							X	X		X
North Trout Lake	48		p	X		X	X			X	X	X		X
South Trout Lake	24		p	X		X	X			X	X	X		X
Upper Gresham Lake	27		p	X							X	X		X
Cunard Lake	33		p	X							X	X		X
Buffalo Lake	52		p	X			X				X	X		X
Carrol Lake	19		p	X							X	X	X	X
Clear Lake	98	r	p/f	X	X	X	X			X	X	X	X	X
Indian Mounds Area	39		p	X					X	X	X	X		X
Jag Lake (Group)	50	r	p	X					X		X			X
North Muskellunge (Group)	50	r	p	X					X		X			X
Canoe Campsites	74		p								X			
Wilderness Campsites	12	r	p								X			X
Day Use Areas:														
Clear Lake Picnic Area			p	X					X	X	X			X
Little Star Picnic Area			p	X					X	X	X			X
Nichols Lake Picnic Area			p	X						X	X			X

Source: NH/AL State Forest Staff, 2000.

ized recreation and timber harvesting. The Indian Creek, Partridge Lake and Frank Lake Wild Areas, which total 27, 900 acres, are open to snowmobiles and some timber harvesting, but are closed to other public motorized uses. The NH-AL also has 19 wilderness lakes and 41 wild lakes.

CAMPING

The NH-AL offers 18 developed family campgrounds with approximately 850 campsites, plus two outdoor group camping areas that accommodate up to 100 people. Most of the campgrounds are small and rustic in nature; about two-thirds have about 50 or fewer campsites. These rustic campgrounds have only hand-pumped water and pit toilets. They do not have showers. Just over one third of the family campsites (349) on the forest have the more modern amenities of showers and flush toilets. These are offered at two locations, the Crystal-Big Muskie-Firefly Lakes campground complex and the Clear

Figure 3.3 Percent of Camping Opportunities by Type

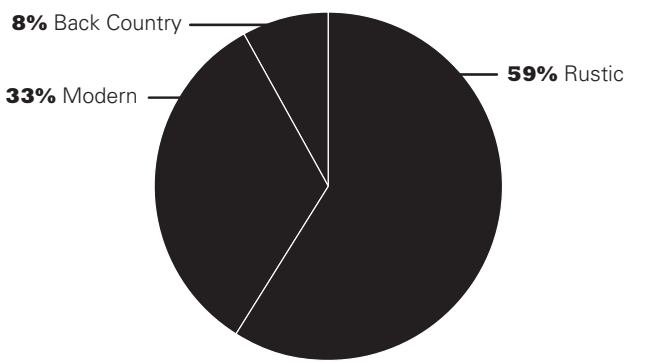


Figure 5.3 illustrates the majority of campsites on the NH-AL are rustic, followed by modern and back-country. Source: WDNR Recreational Supply & Demand 2001.

Lake campground. Electric hook-ups are not provided at any of the NH-AL campgrounds. Six campgrounds offer special facilities for campers with disabilities. Table 3.6 identifies the forest's campgrounds and their facilities.

Remote, primitive camping is highly popular on the NH-AL. There are 74 canoe campsites and 12 wilderness campsites. Access to canoe campsites is by watercraft only and is available on a first come-first served basis. Use is restricted to one night. The wilderness campsites may be accessed by hiking or watercraft, and they may be reserved in advance. Canoe and wilderness campsites are single, remote sites with only a fire ring and open pit toilet.

In addition to designated camping facilities, by special permit the NH-AL allows back-country camping at non-designated sites along approximately 85 miles of back-country trail. Camping permits are also given for off-site hunter camps during the traditional November nine-day gun deer season.

The NH-AL does not provide any fully developed camping opportunities. However, numerous fully-developed camping opportunities are provided throughout the region by the private sector. (Refer to WDNR Recreational Supply & Demand for complete breakdown of camping opportunities.)

HUNTING

There are abundant small and big game hunting and trapping opportunities on the NH-AL.

Each fall the NH-AL State Forest draws hunters from across the state and the region for gun and archery deer hunting in particular. Ruffed grouse and woodcock hunting are also popular. Hundreds of miles of logging roads and non-designated trails are open for hunting. Some unimproved forest roads are open and accessible to street licensed motor vehicles.

DESIGNATED TRAILS

The NH-AL offers a variety of designated trails for all seasons. The term "designated trails" refers to maintained trails where only specified uses are permitted. The forest also has hundreds of miles of logging roads and other paths that are open for hiking, mountain biking, skiing or snowshoeing, and other public use, but these roads/trails are not signed or maintained for recreational purposes. These undesignated trails are discussed further in a following section.

Currently, there are three designated hiking trails totaling 18.5 miles, but no extensive designated trail system for backpackers. Seventy miles of cross country ski trail are available on the NH-AL. Groomed ski trails are among the most popular on the forest. The groomed ski trails include Raven Trail, Madeline Trail, McNaughton Trail, Escanaba Trail, Shannon Trail, Razorback Ridge, and the North Lakeland Discovery Center. The NH-AL also has a network of over 400 miles of snowmobile trails. These link state land with private and county snowmobile trails that run throughout the region. Table 3.7 summarizes the NH-AL's designated trails. Some of these trails are dual purpose; for example, mountain bike trails that double as re cross-country ski trails.

UNDESIGNATED TRAILS

Looking at the designated trails alone does not fully describe the trail opportunities on the NH-AL. Hundreds of miles of logging roads and non-designated trails are open for all types of non-motorized uses including hiking, skiing, horseback riding, and mountain biking. Some unimproved forest roads are open and accessible to licensed motor vehicles as well.

Snowshoeing is currently available throughout the forest, except on groomed cross-country ski trails. There are no designated snowshoeing trails. Currently, horseback riders can ride on most of the forest, unless they are in a prohibited area (i.e., nature trails). There are no designated equestrian riding trails. The NH-AL does not have ATV trails. Some town roads within the NH-AL boundary are open to ATVs. Town road routes are under the jurisdiction of individual townships. (Refer to the following section on General Forest Access for more on recreation use policies.)

EDUCATION AND INTERPRETATION PROGRAMS AND FACILITIES

The NH-AL's interpretive programs are extremely popular with visitors. Presently the forest maintains four, self-guided interpretive walking trails (Fallison, Raven, North Trout, and Star Lake). They range from .5 to 2.5 miles long. A water interpretive trail is also maintained on a segment of the Manitowish River. A rustic Nature Center exists in the popular Crystal-Muskie campground complex. Interpretive programs are offered throughout the summer. Educational programs are also offered at the North Lakelands Discovery Center, which is operated on the NH-AL through a land use agreement.

Table 3.8 NH-AL State Forest Designated Trails (Length in miles)

Hiking	Biking	Mountain Biking	Snowmobile	X- Ski	ATV	Horse	Nature
18.5	0	32	400	70	0	0	6.8

Source: WDNR Recreational Supply and Demand 2001.

NH-AL RECREATIONAL TRAIL USE POLICIES

ATV, Cycles and other Motor Vehicles – ATVs and unlicensed off-road cycles may be ridden only on trails designated for their use. Presently, there are no designated ATV trails on the NH-AL. ATVs and unlicensed off-road motor cycles may not be operated on forest logging roads as all state forest roads (including logging roads) are classified by statute as public roads. Therefore, for motor vehicles to be operated on the forest, they must meet the license vehicle requirements set by the DOT and be legally licensed. (A special statutory exemption allows snowmobiles to be operated on public roads that are not normally maintained in the winter.) Some on-off road vehicles meet the street-legal requirements. When licensed, these cycles, 4X4s and other vehicles may operate on open roads (roads that are not gated, bermed or signed as closed.)

Horses – horses may be ridden on any public road, including logging roads, in the forest. They may go on roads that are bermed or gated, unless signed as closed to horses. They may not be ridden on designated nature and hiking or ski trails.

Mountain bikes – mountain bikes can be ridden on the three designated bike trails on the forest (trail pass required) as well as on any public road, including logging roads. They can go behind the earth berms and gates on roads closed to motor vehicles, except in designated wilderness areas. They may also be ridden on cross country ski trails during the off-season. Bikes are not allowed on designated nature trails.

Snowmobiles – snowmobiles are allowed on the Bearskin Trail and designated snowmobile trails on the state forest. They are not allowed off designated trails.

NH-AL STATE FOREST ROAD ACCESS/CLOSURE POLICY

The NH-AL State Forest is a working forest with an active timber management program. A necessary component of the timber management program is the creation or maintenance of logging roads to facilitate the removal of timber. Most logging roads remain open for public use for two years after completion of the timber sale. After this two-year period, they are closed. Circumstances that may cause road closure *prior two years* include:

- Reduction of fire hazard
- Reduction of garbage dumping incidents
- Restoration of wild land character
- Attention to public safety and reduction of liability
- Protection of the integrity of special use areas
- Protection of natural and artificial tree regeneration
- Protection of wildlife openings
- Protection of wetlands and water resources from erosion

Some roads are permanently maintained open for management purposes. Roads that are not bermed, gated, or otherwise blocked, or signed as closed are open for public access by licensed motor vehicles and for all types of non-motorized public use.

USE AND DEMAND

As documented in the property's regional analysis (Rissman et al. 2002), the 225,000-acre NH-AL State Forest plays an important role in providing outdoor recreational opportunities in the region. The NH-AL is dotted with hundreds of beautiful, undeveloped lakes and provides a wide variety of recreation. The NH-AL is centrally located in northern Wisconsin close to the tourist communities of Minocqua, Woodruff, Rhinelander, and Eagle River. It is the largest and most visited state property with more than two million visitors annually from across Wisconsin, as well as from Illinois, Iowa, Minnesota and other states. Recreating on the NH-AL is a regular part of the culture and lifestyle of many local residents in Vilas, Oneida, and Iron Counties. For some people the NH-AL is a vacation destination or a place to get together with family and friends. Many visitors say their families have come to the NH-AL for generations and may continue to do so.

The NH-AL is a popular vacation destination year round, but most people visit during the peak season from Memorial Day through Labor Day. Visitors have increased steadily over the past decade. NH-AL staff estimate that in 2001 there were about 340,000 boaters and anglers, 150,000 swimmers and picnickers, and 22,000 canoeists. During the peak season, demand for camping on the NH-AL is high. Crystal-Muskie, Clear Lake, and Firefly Lake (three large campgrounds with flush toilets and showers) are at capacity almost all summer long. Campsites at Crystal, Muskie, Firefly and Clear Lake campgrounds may be reserved on the automated PARRS reservation system from Memorial Day through Labor Day. In total, the NH-AL hosts nearly 300,000 campers annually.

Similarly, users visit the NH-AL for the miles of various trails. NH-AL staff estimated that in 1998 there were 58,000 mountain bikers, 29,000 hikers, and 6,000 horseback riders. Staff estimated 57,000 cross country skiers in 1996 and only 9,000 in 1998, due to variable snow conditions. The NH-AL's 400-mile snowmobile trail system is extensive, popular, and well-maintained, but use also varies with snow conditions. NH-AL staff found that snowmobilers fluctuated between 175,000 in 1996 and 42,000 in 1998.

Although the NH-AL provides a relatively small amount of land in the region, general observations suggest that hunting pressure per acre is greater there, due to its high visibility, familiarity, good quality habitat, and ready access. There are abundant small game and big game hunting and trapping

opportunities on the NH-AL. Staff estimated that in 1998 there were about 178,000 hunters.

Even with two million visitors annually to NH-AL, the number of visitors is expected to grow. According to staff estimates, the greatest growth in recent years was in hunting, fishing and boating. The activities showing the most rapid growth on the forest are hiking and canoeing.

The primary issues affecting recreation management are silent-sport versus motorized forest users, crowding, personal safety, camping and campground amenities, and timber harvesting. Perhaps the most contentious of these issues is between the non-motorized/motorized users in relation to use of state lands, which have been the mainstay of silent-sport user groups. Projections indicate that over the next ten years the silent-sport user group, which is many times larger than the motorized user group, will add the most new participants. Projections for motorized recreation, on the other hand, show that jet-skiing and ATV riding are among the fastest growing sports (the demand for more ATV riding opportunities is already high and is bound to escalate as the sport grows).

Therefore, the difficult problem facing state forest recreation managers and planners in this time of increasing recreational use and conflict is how to provide quality opportunities without one style of recreation dominating, displacing, or overly affecting the experiences of others. To meet the wide and ever-growing outdoor recreation demands of the public, recreation providers will need to work together, each providing a part of the "recreational pie" (refer to WDNR Recreational Supply & Demand for detailed analysis).

CULTURAL RESOURCES

The earliest evidence of human habitation in the NH-AL area dates back thousands of years. Early use of the area by native peoples is documented through research on over 60 sites on the NH-AL alone. An archaeological survey of land surrounding Trout Lake, located within the NH-AL boundary, resulted in the identification and documentation of 11 previously unrecorded sites (Egan-Bruhy 2001). Nine of the sites are located on the NH-AL State Forest; two sites are located on land owned by the University of Wisconsin. Eight of the sites on public land are considered potentially eligible for the National Register of Historic Places.

The sites include both logistical and residential camps, which range in age from at least the Late Archaic period to the Late Woodland (around the seventh century A.D. until European contact, circa 1700). Both at the Trout Lake survey area and elsewhere in northern Wisconsin, the highest frequency and largest sites are attributable to the Woodland occupation. Characteristic features of Woodland culture include the construction of earthen mounds, which appear to have served both mortuary and ceremonial purposes, along with the introduction of horticulture (refer to Egan-Bruhy 2001 for additional information).

Today, the reservation for the Lac du Flambeau band (part of the Ojibwe tribe) borders the NH-AL to the west. Many Native Americans participate in gatherings such as pow-wows, creation of Native American artwork, and a continued use of natural resources through hunting, fishing, and gathering bark and medicinal plants. The Lac du Flambeau cultural center and museum offers educational programming to visitors. Lac du Flambeau has also undertaken a major effort to identify and preserve historical and cultural sites on the reservation.

The cultural resources of the NH-AL and surrounding region are best understood in light of the region's history. Native Americans, loggers, early pioneers, and tourists all came to central northern Wisconsin for its natural resources, scenery and ability to renew the spirit. While efforts have been made to educate visitors on the cultural resources of the area, more opportunities are available to incorporate cultural resources into education and outreach efforts on the NH-AL, linking the state forest with the Lac du Flambeau reservation, historic and prehistoric landmarks, and the history of loggers, pioneers, and early visitors.

SOIL SUITABILITY FOR RECREATIONAL USE

While it is important to understand use and demand when considering recreation development, it is also important to understand soil suitability and limitations. The soil surveys for Vilas and Oneida counties express the degree of soil limitations ranging from slight, to moderate, to severe.[8] As discussed in the soil surveys, the suitability ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered; soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. The capacity of the soil to absorb septic tank effluent and its ability to support vegetation are also important considerations (refer to the soil surveys, Natzke 1988, Boelter 1993, for a more complete discussion of use and management of soils, and soil series descriptions).

In general terms, the soils suitable for camp and picnic areas are well-drained with moderate permeability, and level to

[8] Slight means that soil properties are generally favorable and that limitations are minor and easily overcome; severe means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

gentle slope. Suitable soils in the NH-AL area are in the following soil series: Alcona, Pence, Karlin, Manitowish, Padus, and Keweenaw. Many of the NH-AL soils are unsuitable due to wetness, slope and soils being too sandy. Because of the high potential for soil variations on any given site, an on-site soil suitability analysis would be necessary before siting new or expanding existing campgrounds and picnic areas. In addition to the soil attributes listed above, the analysis would also examine suitability for sanitary facilities where those facilities would be constructed.

Soils suitable for path and trail development have similar features to those for camp and picnic areas. The soil survey notes the best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface. Based on the Vilas and Oneida soil surveys, approximately 55 percent of Vilas County and 41 percent of Oneida County contain soils with severe limitations for path and trail development. Soils limitations for the NH-AL would be similar. Common restrictive features include wetness, slope, and soils that are too sandy.

REGIONAL ANALYSIS SUMMARY

As part of the planning process, the Department prepared an analysis of the ecological, economic, recreational, and social conditions, opportunities and constraints associated with the NH-AL on a local and regional scale (Rissman et al, 2002). The purpose of the regional analysis is to help reveal the best niche or role for the property locally and in the region. The following are the findings of the regional analysis.

The Northern Highland-American Legion State Forest plays a significant role in central northern Wisconsin. Although the NH-AL makes up only 5 percent of the land in the six-county region, it stands out for possessing one of the highest lake densities in the world, being the largest public property in an area with extensive dry forest communities, and offering a diverse "recreation package" near one of the most rapidly developing tourist centers in the region.

The abundance of kettle lakes on the NH-AL draws people from across the state and the midwest for boating, fishing, and swimming. These same lakes provide excellent habitat for large concentrations of eagles, osprey, and common loons. Lakeshore development has been rapid in the region, with heavy pressure from the booming housing market in particular. As tourism and development increase, the undeveloped lakes of the NH-AL and the availability of non-motor lakes will become even more prized than they are today.

Land and Water Resources: The NH-AL is the largest public property in the Northern Highland Pitted Outwash, a broad ecological subsection that is unique for its sandy soils and rolling topography with abundant kettle lakes and wetlands. The ecological conditions on the NH-AL State Forest offer regionally significant opportunities to manage for pine dominated, dry to dry-mesic forests at a large scale. An important opportunity exists to manage mesic hardwood hemlock types because significant stands of more mature stages currently exist.

Numerous large, relatively undisturbed bogs and conifer swamps, as well as rare and uncommon rich fens and rice marshes, occur on the property. The opportunity to protect and manage these types could be pursued. There is an opportunity to manage for large-scale, extensive forests because fragmentation is moderate. Extensive forests could benefit forest interior species, including neotropical migrant birds, as well as disturbance-sensitive predators and certain habitat specialists. This property contains a globally significant concentration of freshwater kettle lakes, many of which have rare aquatic plants and invertebrates. Development pressure on these lakes is very high. Many rare aquatic plants and invertebrates also occur in the rivers on this property. Regionally significant breeding populations of bald eagle, osprey, common loon, and other water-dependent wildlife dwell here. Opportunities to preserve and restore these aquatic resources could be pursued.

The NH-AL is also important on a larger scale, connecting to national, county, and state properties and other large blocks of forest. A potential boundary expansion to the north could connect with the Ottawa National Forest, providing a valuable connection to large blocks of undeveloped land to the north.

Recreational Resources: Public outdoor recreation in central northern Wisconsin is provided by a mix of federal, state, county, tribal, and private landowners. The region offers high quality forest and water-based recreation. Increasingly, recreational providers will need to work together—each providing that part of the recreational pie that it can best provide—to meet the region's wide and ever-growing outdoor recreation demands. People generally consider state forests to be somewhat more developed than national forests, but less developed than state parks. State forests are considered a primary provider of silent-sport recreational opportunities in northern Wisconsin. Campers, also, look to the state forests for a high quality rustic camping experience.

The NH-AL and nearby tourist areas have long been a major vacation destination area. The NH-AL offers visitors an exceptional combination of diverse forests, lakes, and streams along with a range of quality outdoor recreational opportunities in a readily accessible location.

Due to the many lakes and streams, water recreation on the NH-AL is popular. Though the NH-AL provides only a small percentage of land open to public hunting, it is popular because of its diverse, high quality habitat and high visibility, familiarity,

and ready access. The NH-AL is also an important provider of wild resources recreation, especially wild/wilderness lakes, which are rare in the region.

The NH-AL is only a minor provider of designated trail opportunities in the region, except for snowmobile trails. However, it is one of the major trail providers in Vilas and Oneida Counties. In terms of total number of campsites, the NH-AL is slightly behind the national forest, but it offers the most balanced array of non-electrified camping in the region. ATV access is a growing issue as ATVs are not currently allowed on the NH-AL; however, ATV riders are looking for riding opportunities on the property. This is a change opposed by many non-motorized recreational NH-AL users. Because ATV trails and road routes currently border the NH-AL on only one side in Iron County, the NH-AL is not needed to connect existing regional ATV trails.

Social-economic and Cultural Role of the NH-AL: People and households in rural resource-dependent regions of Wisconsin have traditionally relied upon natural resources for economic sustenance. The NH-AL lies at the heart of central northern Wisconsin, supporting local communities through both forest products and forest- and water-based recreation. Management of the forest has an impact on the socioeconomic ties that bind residents and visitors to the forest. A recent study shows that timber production and recreation are generally compatible land uses.

While some efforts have been made to educate visitors on the cultural and historical resources of the area, more opportunities are available to incorporate cultural resources into education and outreach efforts on the NH-AL, linking the state forest with local tribes, landmarks, and the history of Native Americans, loggers, pioneers, and early visitors. Natural resources education is available in the region through school programs, camps, and interpretive programs. The NH-AL has an opportunity to expand its facilities to educate the public about natural resources and forest management.

Given the increasingly complex nature of natural resources management, understanding the niche of the NH-AL in its region is critical. As Wisconsin's largest state forest, the NH-AL has a significant role to play in providing ecological, economic, recreational, and cultural benefits to the region.